# The French experience for LILW disposal


## Dr Gérald Ouzounian

## Andra International Dpt - Director


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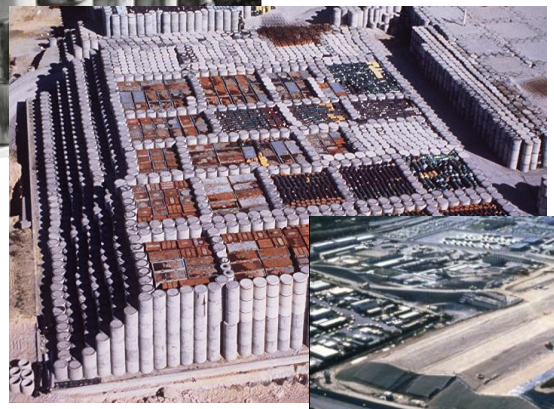
# 46 years of experience in design, studies and operations, An unequalled experience since Centre de la Manche



**25 years of operation : 1969-1994**
**527,000 m³ of waste packages disposed of**

**License for the institutional control period: 2003**

**12 years of institutional control**
**(the beginning of a long story)**

From operation…

…… to closure

…… and to institutional control

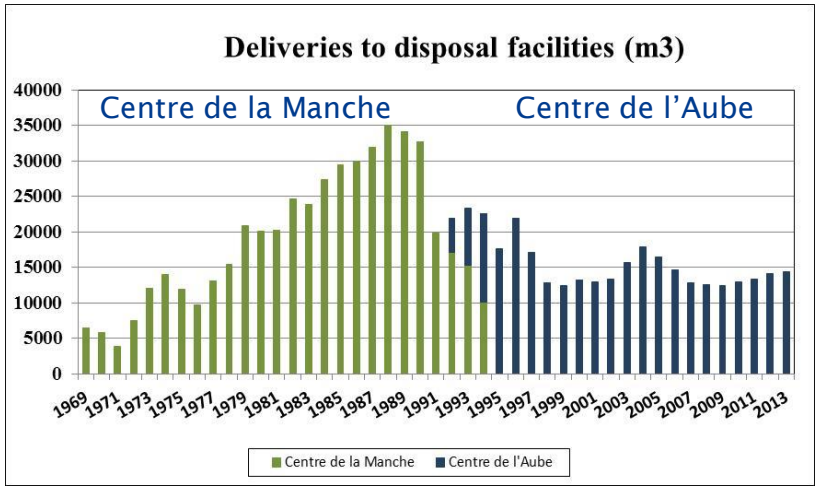
# Experience valued with the Centre de Stockage de l'Aube

**Construction license:** 1989
**Commissioning:** 1992

**Capacity:** 1,000, 000 $m^3$

**Initial design for operational waste (30 000 $m^3$/year)**

**Volume disposed of :** 292 000 $m^3$ (end 2014)




**To 60 years of operation**

**A facility that should accommodate operational waste and decommissioning waste from existing or already decided facilities**

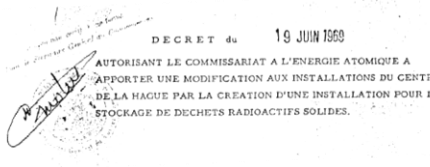
# le stockage de l'Aube, LIL-SL waste

# The development of safety principles

- **1969: initial stage**
  - one barrier: package or vault
  - Intermediate level waste > 1000 MCDW
    (maximum concentration in drinking water)
    ➔ Concrete blocks or grouted cells

- **1984: safety guides (1984)**
  - Multi-barrier system
  - Management phases
    - Short term and long term safety
  - Conditioning principles
    - Containment requirements

- **Guides used for the design of Centre de l'Aube and still applicable**



DECRET du 19 JUIN 1969

AUTORISANT LE COMMISSARIAT A L'ENERGIE ATOMIQUE A APPORTER UNE MODIFICATION AUX INSTALLATIONS DU CENTR DE LA HAGUE PAR LA CREATION D'UNE INSTALLATION POUR L' STOCKAGE DE DECHETS RADIOACTIFS SOLIDES.

**RÈGLE N° I-2**
(19 juin 1984)

*Tome 1 :* Conception générale et principes généraux applicables à l'ensemble de l'installation.

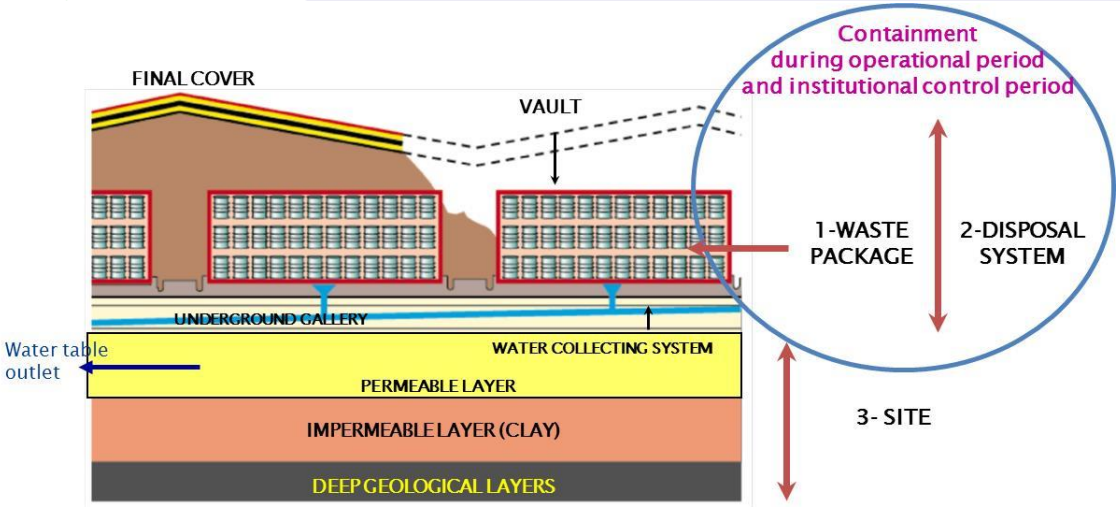
*Chapitre 2 :* Principes généraux de conception et d'installation.

OBJET : **Objectifs de sûreté et bases de conception pour les centres de surface destinés au stockage à long terme de déchets radioactifs solides de période courte ou moyenne et de faible ou moyenne activité massique.**

*Domaine d'application :* Centres de surface destinés au stockage à long terme de déchets radioactifs de période courte ou moyenne et de faible ou moyenne activité massique.

*Révision n° 1 :* Date et référence du texte précédent : S.I.N. n° A 5350/82 du 8 novembre 1982.

# Basic safety principles



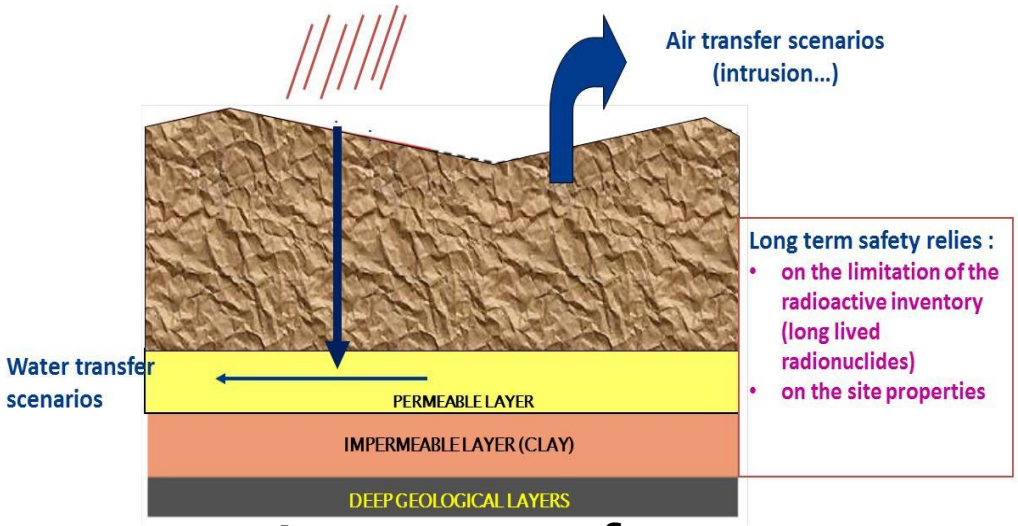

**Short term safety**

## Operation

## Institutional control period
(no more than 300 years)

## Post institutional control period

Assuming a loss of memory
➔ No significant hazard




**Long term safety**

# Improvement of knowledge
# A feed-back from Centre de la Manche to Centre de l'Aube

## Minimization of effluents during operation

- Centre de la Manche: operated in the open air
- Centre de l'Aube: mobile shelters

Centre de la Manche

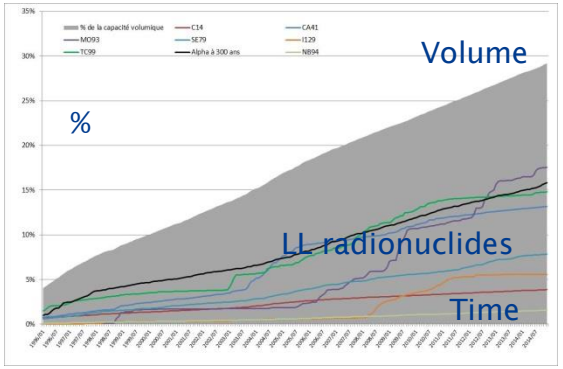
Centre de l'Aube

## Long lived emitters limitations

- Alpha emitters < 370 Bq/g (mean value)
- Restrictions for radium bearing wastes (radon in the monitoring gallery)

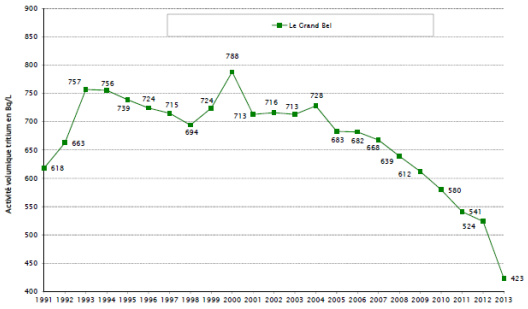
## A cautious approach of tritiated wastes

- Centre de la Manche : a contamination by tritium in the groundwater and in the rivers
  - Maximum: 4 000 Bq/l in the river ➔ not a safety issue, Wastes removed
  - Plume propagation in the groundwater
  - Present hypothetical impact: 0.3 µSv/Year, Contamination decreasing
  - However still a communication issue




Centre de l'Aube: follow up of capacity

Monitoring gallery




Plume at the source of a river

***Safe does not always mean acceptable***

# A feedback from Centre de la Manche to Centre de l'Aube
## Maintaining memory

## Keeping memory as long as achievable:

- A synthetic memory
  - 1 report of 170 pages
  - Assessed by the local information commission
- A detailed memory
  - More than 10.700 documents
  - more than 443.000 pages
  - Assessed by national and international review panels


ANDRA

ARCHIVE HISTORIQUE
(mémoire de synthèse d'un centre de stockage)

Identification : DD.NSY.ADSQ.07.0017
Nom du FDR : CSM
Code WBS : Mémoire
Arborescence :

Émetteur : DSQE | Repère support/Secrétaire : DD.NSY.ADSQ.07.0017.A.doc | Date d'origine : 09/03/2007 (V0.1) | Page : 1/169

**Centre de stockage de déchets radioactifs de la Manche (50), situé sur la commune de Digulleville**

**Mémoire de synthèse pour les générations futures**

**(destinée à maintenir une connaissance minimale aux générations prochaines et à toutes celles qui se succéderont jusqu'en 2500 au moins)**

Documents associés :

Ce document, bien que propriété de l'Andra, peut être reproduit ou communiqué sans son autorisation

| Ind. : | Date : | Nom et visa Rédacteur : | Nom et visa Vérificateur : | Nom et visa Approbateur : |
|---|---|---|---|---|
| A | 29/02/2008 | Patrick CHARTON | Bruno CAHEN | Francis CHASTAGNER |

Agence nationale pour la gestion des déchets radioactifs

**Implementation of preservation long term records performed at Centre de l'Aube**


Storage of documents at National Archives in Fontainebleau


Copy of documents on "permanent paper"

# Improvement of knowledge :demonstrability of safety concepts
# Example of the capping system: scientific studies

Experimental clay capping system
(Centre de l'Aube)

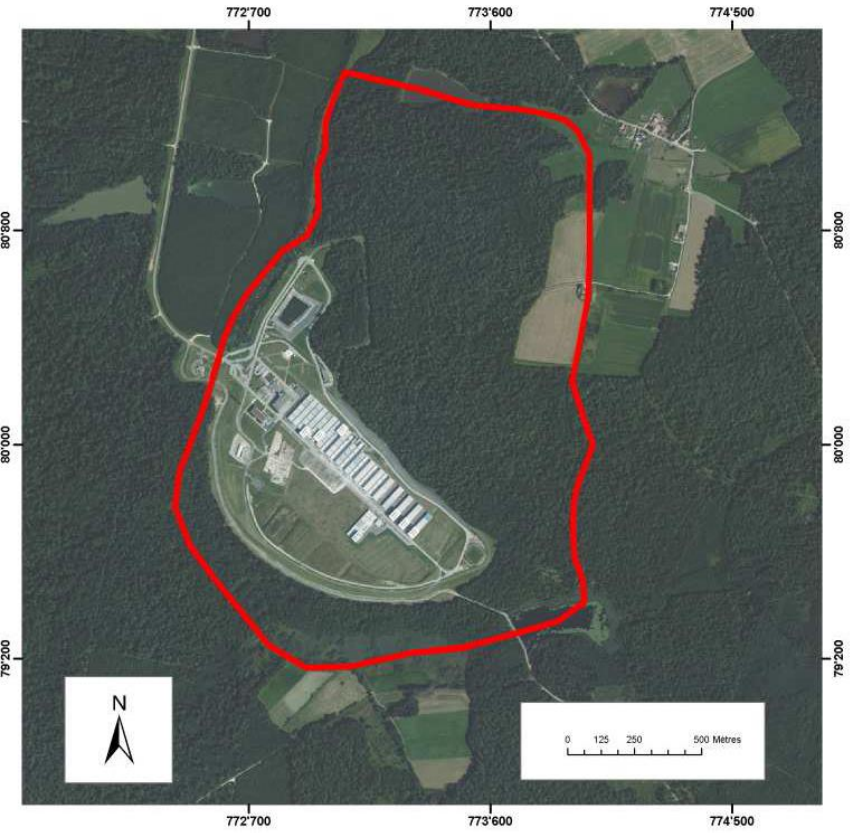
Studies on ageing of the
bituminous membrane
(Centre de la Manche)

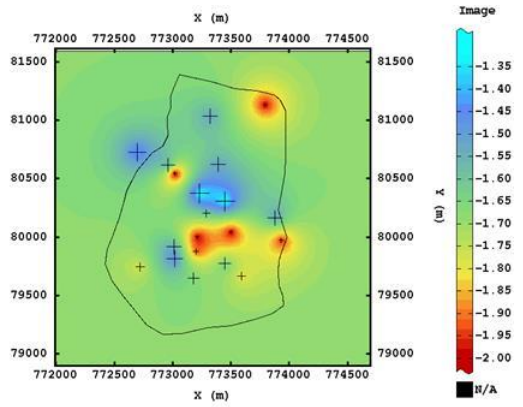
Investigation and
remediation on site
(Centre de la Manche)

Development of flora
on site
(Centre de la Manche)

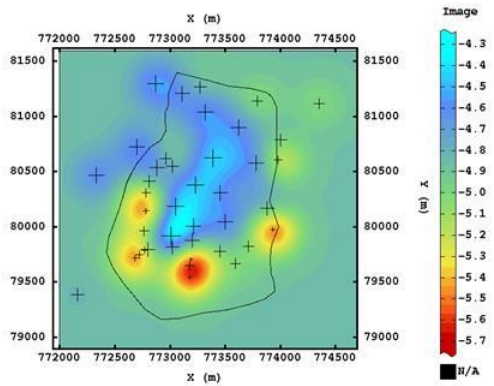
**Periodical progress reports**

# Improvement of knowledge :demonstrability of safety concepts
## Water transfer model



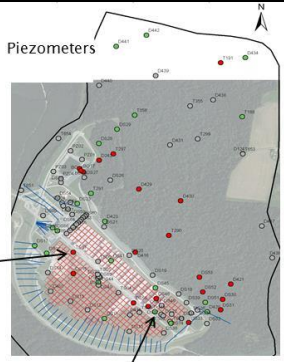

Storage measurements

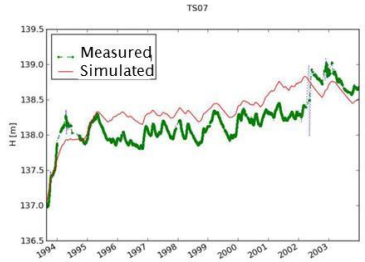



Permeability measurements

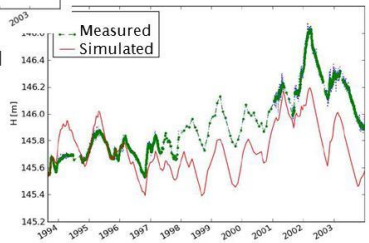
**Periodical re-assessment of the hydrodynamic model (Centre de l'Aube)**

- Calibration Index : 23 cm
- Validation Index : 34.8 cm




Measured and simulated water levels at TS07



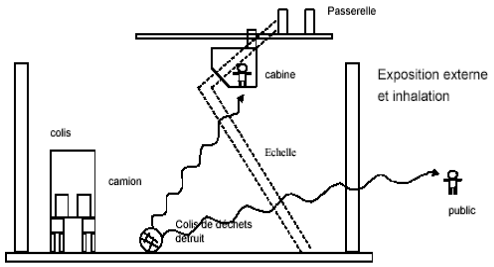

Measured and simulated water levels at TS02

# Defence in depth
# An important tool: the acceptance process

## 1. Waste acceptance criteria

- **A description of the domain for waste packages (in some cases a restricted part of this domain):**
  - **For which the design is valid**
  - **For which the safety analysis is valid**
- **A tool to mitigate unexpected events**

Prevent

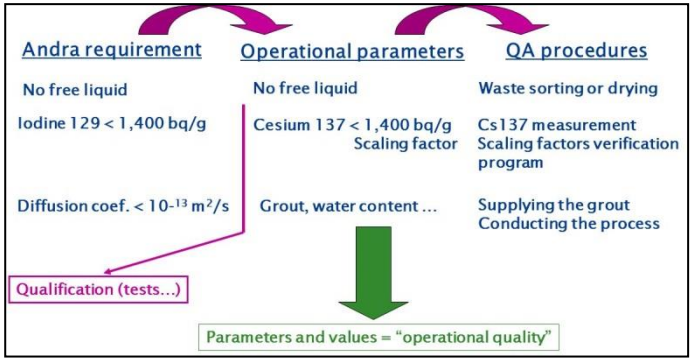



Mitigate

## 2. Acceptance process

- **Obtain confidence prior production in the waste generator's capacity to manufacture packages complying with WAC**
  - Qualification with respect to WAC
    ➔ Acceptance file
  - Assessment of QA/QC in the generating facility
    ➔ Delivery acceptance

*A contract between Andra and waste generator*




Waste acceptance process


Training

- **Maintain confidence during production**
  - Computer checks by Andra of waste packages declared data
  - Checks by Andra at delivery (visual, dose rate)
  - Inspections/audits at the generators' sites
  - **Destructive and non destructive tests by Andra**

tests

# Flexibility: specific design and safety case for the management of large disused components

Vessel heads


Remote handling system of a pilot reprocessing plant

Specific disposal design

Specific safety case

Specific acceptance criteria

Specific regulatory approval

Decontaminated steam generator (VLL)

Fast breeder lateral neutronic shieldings

# Public involvement

## During the site selection process:

- Local elected representatives, with a strong support of the national level
- Project owner
  - Siting process and Environmental integration of the facility
  - Design of the facility
  - Integration of the project in the territory

## During the operation of the facility and after its closure:

- Local Information Committee
- Local elected representatives
- Project owner
  - Visits and open house days, to create a real dialogue
  - Environmental surveys
  - Memory keeping (working groups)

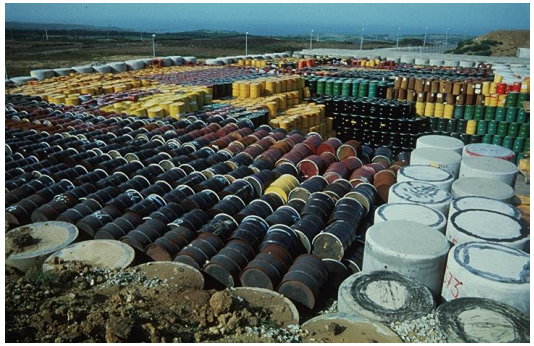
# Dialogue with the society

A local industrial company and a partner for the local life

Different supports and structures for the dialogue
Visitors center
Open doors days
Local information commission
Local and national Andra's "journal"
Website…

# Changes in social expectations

Repository

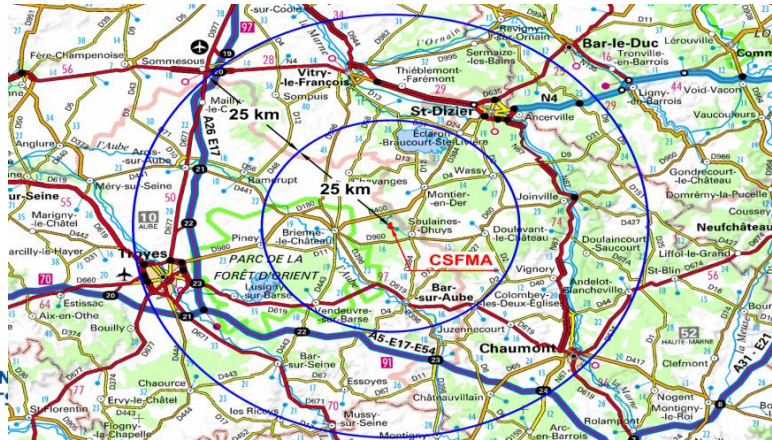


Disposal facility

# Support to the local development

- Initial support set at 3,5% of the construction cost (8.8M€)
  - Use decided by local elected people and state representatives
- Local procurement
  - 4,5M€ of local purchase, from a total of 18 M€
- Employment
  - 300 direct and indirect positions in a rural environment
- Local taxes
  - 8.2 M€/y (property tax, company tax, additional tax)
  - Representing between 50 and 80% of the local tax incomes
- Sponsorship
  - Environment, solidarity, scientific culture, local citizens action

This direct socio-economic link between our activity and the local community facilitates the corresponding communication with the public as this benefit for the hosting territory is now well-known and it remains one of the most powerful tools to drive our project locally



# Fundamental rule for incentives

Everything must be done to motivate, concern and increase the benefit felt by politicians and the public, **but in greater transparency** to avoid the syndrome of “buying consciences”

If you are not comfortable to publicly explain the actions carried out, don’t do them, because ultimately it will not serve the project but your opponents

Of course There is a time for transparency. Transparency should not be synonymous with naivety

# Sucess factors

- Political framework with independant review bodies
- Site selection on the basis of voluntary sites
- Step by step approach
- Mobilisation and involvement of national representatives
- Mobilisation and involvement of local elected representatives
- Independence of Andra
- Strong involvement of Andra
  - Local participation
  - Dialog with local and national stakeholders
  - Local involvement
  - …
- Involvement of waste producers
- Local development project/scheme and funds for it
- Information and Oversight Committee

# Conclusion

- 46 years of technical experience on design and studies
- 46 years of governance experience with National and with Local decision makers and with the Public
- 46 years of operations, providing an unequalled experience for the direct feedback on design and studies
- 46 years of safety management, not only on the paper but also at the sites
- 46 years of continuous progress